The University of Manitoba

A COMPARISON OF THE EFFECTS OF INDIVIDUAL AND SIMULTANEOUS PICTURE CARD PRESENTATION ON THE ACQUISITION, RETENTION, AND GENERALIZATION OF PICTURE NAMES DURING PICTURE NAME TRAINING WITH MENTALLY HANDICAPPED CHILDREN

by

Valdine Huyghebaert

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ABSTRACT

A comparison of the effects of presenting one picture card on each trial (individual presentation) and two picture cards on each trial (simultaneous presentation) during picture name training with mentally handicapped children was conducted. Following baseline assessments of imitation and naming responses, training was carried out using a multi-element design in which the two conditions were studied concurrently. An interspersal instructional sequence which involved alternating a picture card which the child could name with one the child could not name was used as the general training procedure within which to compare the two conditions. On each experimental day one session per condition was conducted with counterbalancing of sessions across days. The major dependent variables included: (a) correct responses for the known and unknown picture cards to prompt trials, in which the child was required to imitate the name of the picture card as modeled by the trainer in the presence of the picture card; (b) correct responses for the known and unknown picture cards to probe trials, in which the child is required to name the picture card when asked "What's this?" by the trainer; (c) average number of trials to

reach criterion; and (d) the cumulative number of picture names learned over sessions in each training condition. Bi-weekly retention and generalization tests to another trainer and in another setting were also conducted. Results indicated that both conditions were equally effective in teaching picture-names with regard to measures of acquisition of naming responses and percentage of correct responses to prompt and probe trials. Implementing the individual condition during training and the simultaneous condition during testing resulted in slightly greater percentages of words retained than other combinations of training and testing. This effect was consistent across all three children. The results were discussed in terms of discrimination training, competing responses and stimuli and situational stimuli. It was concluded that none of these factors appeared to fully account for the results.

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INTRODUCTION

Operant techniques have been successfully implemented to develop naming responses with mentally handicapped individuals (Bricker & Bricker, 1972; Silverman, Anderson, Marshall & Baer, 1986), psychotic individuals (Koegel & Rincover, 1974), the hearing impaired (McReynolds, 1984), the severely physically disabled (Hurlbut, Iwata & Green, 1982), and normal children (Manos, 1983). The procedures generally involve reinforcing correct verbal responses to the trainer's model in the presence of a training stimulus (e.g. picture card). The trainer's vocalizations are then faded out so that the training stimulus alone becomes a discriminative stimulus for the subject's response. Numerous training strategies for teaching verbal responses have been developed and typically include (a) using a specific instructional sequence (e.g., serial, interspersal, or concurrent) to govern alternation of trials (as described in Table 1); and (b) a reinforcement system to govern consequation of correct responses according to a specific schedule of reinforcement.

Table 1.

Serial, Concurrent, and Interspersal Training Procedures

	TRIALS			
INSTRUCTIONAL SEQUENCES	1	2	3	4
SERIAL	UK1*	UK1	UK1	UK1
CONCURRENT	UK1	UK2*	UK1	UK2
INTERSPERSAL	UK1	K**	UK1	K

* UK1 and UK2 = unknown words to be trained
** K = known word

A serial sequence involves presenting one item to be trained on consecutive trials until some mastery criterion is reached. An interspersal sequence involves presenting two items - one item to be trained and one item which the subject has previously mastered - in trials that alternate in a predetermined manner to some mastery criterion. A concurrent sequence involves presenting two items in an alternating fashion where neither item has been previously mastered.

Some studies investigating the efficiency of the various training strategies indicate that a concurrent training sequence is more effective than a serial sequence for retention of naming responses (Cuvo, Klevans, Borakove, Borakove, Van Landuyt, & Lutzker 1980) or for generalization of naming responses (Schroeder & Baer, 1972; Panyan & Hall, 1978). Moreover, one study suggests that an interspersal sequence results in greater acquisition and retention than a non-interspersal (concurrent) sequence (Neef, Iwata, & Page, 1980). A further comparison of interspersal and concurrent training sequences (Rowan & Pear, 1985) supports Neef et al.'s results for acquisition but not for retention and generalization.

An examination of the training strategies employed in the above studies revealed some procedural differences which may have accounted, in part, for their different

findings. One difference concerns whether the method of presentation of the training items involves simultaneously or individually presenting items during each trial. In both the interspersal and concurrent instructional sequences two items are alternated and the trainer may, on each trial, either (a) present an item individually (e.g., by placing one picture card in front of the trainee) or (b) present two items simultaneously (e.g., by placing the two picture cards in front of the trainee at the same time and pointing to the particular picture card to which the trainee is required to respond). The first method of presentation has been implemented more frequently (e.g.,Panyan & Hall, 1978; Neef et al., 1980; McIlvane & Stoddard, 1985; Silverman, Anderson, Marshall & Baer, 1986); however, a simultaneous presentation procedure (Cuvo et al., 1980) may enhance stimulus discrimination during training.

Cuvo et al. (1980) suggest that simultaneous presentation of stimuli may be advantageous because training one item in the presence of others may present multiple discrimination trials, since other discriminative stimuli are available on each trial. This may have implications firstly, in choosing an instructional sequence. Interspersal and concurrent instructional sequences may be more effective than serial sequencing because the alternation of stimuli within a session

enhances the discrimination training occurring during the session. Secondly, it may have implications in choosing the method of presenting stimuli on trials during the instructional sequence. Simultaneous presentation of stimuli during training trials may be even more effective than individual presentation because, rather than alternating, both stimuli are present on each trial and thus, discrimination training would occur on each trial, not just over the session.

One may conceptualize a ranking of types of training sequences along which opportunities for more effective discrimination training exists (see Table 2). The ranking may consist of: (1) a serial sequence (one item trained on successive trials to criterion), where there is little or no opportunity for discrimination trials; (2) an interspersal or concurrent sequence, with individual presentation of stimuli (two items alternated on trials), where discrimination training occurs across trials within a session; and (3) an interspersal or concurrent sequence, with simultaneous presentation of stimuli (both items are presented on each trial), where there is the added possibility of discrimination training within each trial. Thus, with respect to discrimination training, one might categorize the third sequence to be the most effective training strategy of the three.

Table 2.

Acquisition, Retention and Generalization Results for Individual and Simultaneous Stimulus Presentation for Serial, Concurrent and Interspersal Instructional Sequences Ranked According to Possible Effectiveness of Discrimination Training

	RANKING OF DISCRIMINATION TRAINING							
	A	B		C				
POTENTIAL FOR DISCRIMINATION TRAINING	NO DISCRIMINATION TRAINING	DISCRIMINATION TRAINING /SESSION		DISCRIMINATION TRAINING /TRIAL				
METHOD OF PRESENTING STIMULI	INDIVIDUAL	INDIVIDUAL		SIMULTANEOUS		RESULTS		
TRAINING CONDITIONS	SERIAL	CONCURRENT	INTERSPERSAL	CONCURRENT	INTERSPERSAL	ACQUISITION	RETENTION	GENERALIZATION
	1	2	3	4	5			
CUVO ET AL. (1980)	●			●		S>C	C>S	
SCHROEDER & BAER (1972)	●	●				S=C		C>S
PANYAN & HALL (1978)	●	●				S=C	S=C	C>S
NEEF ET AL. (1980)		●	●			I>C	I>C	
ROWAN & PEAR (1985)		●	●			I>C	I=C	I=C

On examining previously mentioned studies in terms of this ranking (see Table 2) one can see that those procedures which included a greater amount of discrimination training, (categories B and C in Table 2) produced better results on important measures of retention (Cuvo et al., 1980) or generalization (Schroeder & Baer, 1972; Panyan & Hall, 1978). Those studies comparing procedures in which there was seemingly not a greater amount of discrimination training in one procedure than in the other with this ranking (Neef et al., 1980; Rowan & Pear, 1985) either; produced equal results for both conditions in important measures of retention and generalization (Rowan & Pear, 1985) or; found greater results on retention (Neef et al., 1980), possibly due to the additional training the unknown item received after reaching criterion in the latter study.

Examination of a serial procedure, an interspersal (or concurrent) procedure with individual presentation of stimuli, and an interspersal (or concurrent) procedure with simultaneous presentation of stimuli outlines potential advantages and disadvantages within procedures (see Table 3). In a serial procedure the individual is required to make only one response to the same stimulus on every trial of the session. Since only one stimulus is presented on each trial throughout the session interference from other stimuli would be minimized and one would expect fairly

Table 3.

Serial, Interspersal/Individual
and Interspersal/Simultaneous
Presentation Methods

UK and K Refer to the
Known and Unknown Picture Cards.

	TRIALS				
TRAINING PROCEDURES	1	2	3	4	POSSIBLE EFFECTS
SERIAL	UK	UK	UK	UK	-NO INTERFERENCE & RAPID ACQUISITION -NO DISCRIMINATION TRAINING
INTERSPERSAL INDIVIDUAL	UK	K	UK	K	- ↑INTERFERENCE & FAIRLY RAPID ACQUISITION -DISCRIMINATION TRAINING WITHIN SESSION
INTERSPERSAL SIMULTANEOUS	UK/K	K/UK	UK/K	K/UK	-INTERFERENCE POSSIBLY INCREASES -DISCRIMINATION TRAINING WITHIN TRIALS

rapid acquisition. However, a disadvantage of this procedure may relate to the fact that these rapidly acquired responses may be less likely to come under appropriate stimulus control since the procedure does not involve discrimination training for two different responses emitted in the presence of two different stimuli.

The interspersal procedure with individual presentation of stimuli shares some similarity with the serial procedure in that on any one trial only one stimulus is presented and only one response is required. Although two stimuli are alternated across trials, the procedure does not provide for discrimination training of each response on any one trial. Again, similar to the serial procedure an advantage may be that competing responses may be minimized during each trial since only one stimulus is presented at a time.

In the interspersal procedure with simultaneous presentation of stimuli, like that with individual presentation of stimuli, two responses are required of the individual. However, on each trial of this procedure one stimulus may be considered an S+ and one an S-. Thus, the procedure provides for discrimination training on each trial which would enhance stimulus control. A disadvantage of this procedure may involve the fact that on each trial two stimuli are presented and thus there may be increased

interference due to competing responses. If this is the case, acquisition of responses may take longer with this procedure than with the interspersal procedure with individual presentation of stimuli. However, although the acquisition of responses may require more training time, the responses, once acquired, may be under stronger stimulus control due to being trained in the presence of a number of different stimuli. Thus, retention and generalization may be enhanced (See Table 3 for a summary).

A direct comparison of individual stimulus presentation (discrimination training/session) to simultaneous stimulus presentation (discrimination training/trial) on training trials has not been conducted (B vs C in Table 2). At this point it is not entirely clear whether the interspersal or concurrent instructional sequence is a more effective training strategy. However, an interspersal procedure was chosen for this study because: (a) it has been used effectively to teach picture names (Rowan & Pear, 1985); (b) the interspersal procedure has been reported to be as effective, if not more effective, than the concurrent procedure in some studies (Rowan & Pear, 1985; Neef et al., 1980); (c) in the study by Neef et al.(1980), subjects specifically chose the interspersal condition over the concurrent condition; and (d) in the study by Rowan & Pear (1985), emotional responses were reported more in the concurrent condition

than in the interspersal condition.

The present study investigated the effects of two methods of stimulus presentation - individual and simultaneous - on the acquisition, retention, and generalization of naming responses during picture name training with mentally handicapped children. An interspersal instructional sequence was chosen as the general instructional sequence within which to compare the two conditions. The research may provide a more efficient training strategy to enhance retention and generalization of naming responses.

STATEMENT OF THE PROBLEM

Numerous training strategies for teaching verbal responses have been developed and generally include a specific instructional sequence (serial, interspersal, or concurrent) to govern alternation of trials. Some studies comparing the effectiveness of concurrent and serial instructional sequences reported better results on important measures of retention or generalization with a concurrent sequence. Other studies comparing interspersal and concurrent sequences reported inconsistent results across studies.

Many variations in procedures occurred in the above studies. One variation concerned the method of presenting training stimuli on each trial (individual or simultaneous presentation of stimuli). Cuvo et al. (1980) suggest that simultaneous presentation of stimuli on each trial may be advantageous in that, training one item in the presence of others may present multiple discrimination trials in any one session since other discriminative stimuli are available on each trial.

The purpose of the present study was to examine the effects of individual and simultaneous presentation of

stimuli on the acquisition, retention and generalization of picture naming responses with mentally handicapped children.

METHOD

Subjects

Three mentally handicapped children who were able to imitate simple, one-word responses and had a small naming repertoire participated in this study. The children either lived at, or (in the case of one child) received day treatment at the St. Amant Center, a residential and educational facility for mentally handicapped persons in Winnipeg, Manitoba.

Ronald had been diagnosed as mentally handicapped, cause unknown, with some autistic-like mannerisms. He was 6 years old at the time of this study and was enrolled in the Developmental Day Program which he attended daily. He lived at home with his parents. An assessment with the Yale Developmental Schedule in 1984 indicated a general functioning level at 3 years with some successes at the 3 1/2 - 4 year level compared to a chronological age of 4 years, 10 months. A developmental quotient of 65-70 was reported at this time.

Kenny was diagnosed as mentally handicapped with no known etiology but with some attribution to premature gestation. A seizure disorder presented at 1 year of age, continued to be somewhat active, and required daily medications. Kenny was 18 years old at the time of this study and had resided in one of the cottage units at St. Amant Centre for approximately three years. He attended school within the Center daily. An assessment with the Yale Developmental schedule in 1984 indicated a general functioning level at 3 1/2 years compared to a chronological age of 15 years, 8 months.

Diane was diagnosed with Trisomy 21 Down's Syndrome with an inoperable congenital heart defect. She was 10 years old at the time of this study, had lived at St. Amant for 9 years and resided in one of the cottage units. She attended school within the centre daily. Assessment with the Yale Developmental Schedule in 1985 indicated a general functioning level at 4 years with speech production comprehension at 3 - 3 1/2 years compared to a chronological age of 8 years, 1 month. A developmental quotient of between 45 - 50 was reported at this time.

Setting, Apparatus, and Materials

Individual sessions were conducted for each child in a training room approximately three meters by three meters in the Psychology Research area of the Center. The child and the trainer sat facing each other across a table during each session.

An audio tape recorder was placed on a counter beside the table between the child and the trainer in order to record all verbal responses emitted during each session. A trial timing device, placed beside the tape recorder, was used to signal to the trainer the onset of a trial and of an intertrial interval. A two compartment choice box for holding the primary reinforcers (edibles) was placed in front of the trial timing device. Stimuli presented during picture name training consisted of picture cards chosen from a Peabody Picture Vocabulary Kit.

Experimental Design

The study used a multi-element experimental design (Hersen & Barlow, 1976; Kazdin, 1982) with counterbalancing of sessions each day. Thus, each child received two training sessions each day, where the simultaneous presentation procedure was used in one session and the

individual presentation procedure in the other, and the order of the sessions alternated each day.

Preliminary Assessment Procedure

A preliminary assessment was conducted to obtain picture names which the children knew to be interspersed later between trials during baseline, retention, and generalization tests to ensure that reinforcement occurred frequently enough to maintain responding on these tests. These picture cards were not included during training.

In this preliminary assessment, approximately 60 picture cards were chosen for presentation and were presented in a random order three times each. On each trial the experimenter presented the picture card to be tested face up on the table, pointed to it and asked the child "[Name], What's this?", and allowed the child eight seconds to respond. Each trial was terminated after the emission of a correct or incorrect response within an eight second time period. After a five second intertrial interval a new trial was presented. On every fifth trial a motor imitation trial was presented in which the experimenter said "[Name], do this." and modeled a simple motor response such as clap hands or tap table. On these trials responses were reinforced after each correct response with praise and edibles. These trials were

inserted during the preliminary assessment (and during naming and imitation assessments - described later) to ensure that the child received enough reinforcement to maintain general attending and responding during testing (Martin, 1971; Witman, Zakaros & Chardos, 1971; Bucher, 1973; Welch & Pear, 1980). Picture cards which the child named correctly on all three of the naming assessment trials were considered known and were set aside to be used during further assessment procedures.

Main Assessment Procedures

Two types of main assessment procedures, naming and imitation, were conducted for all children. Approximately 160 picture cards were chosen for presentation and were further divided into eight groups of 20 picture cards each.

Naming assessment

During assessments of each child's naming repertoire the 20 picture cards, selected as described above, were presented in a random order four times. The presentation method alternated between simultaneous and individual presentation methods (described later) across picture cards and across trials for each picture card (see Table 4). Thus, on each trial, the experimenter presented the picture card to be tested face up on the table (either individually

Table 4.

Stimulus Presentation During Naming, Retention and Generalization Assessments

WORDS	TRIALS			
	1	2	3	4
A	*I	S	I	S
B	**S	I	S	I
C	I	S	I	S
D	S	I	S	I
***E	I	S	I	S

*I = INDIVIDUAL PRESENTATION
**S = SIMULTANEOUS PRESENTATION
***E = KNOWN WORD TO BE REINFORCED

or simultaneously with another picture card which the child knew), pointed to it and asked the child "[Name], What's this?", and allowed the child eight seconds to respond. Each trial was terminated after the emission of a correct or incorrect response which occurred within the eight second time period. If no responding (response omission) occurred during a trial, it was considered an incorrect response and the trial was terminated after eight seconds. After a five second intertrial interval a new trial was presented.

On every fifth trial during the naming assessment, a "known" picture card was presented and each correct response was consequated with praise and edibles. If a child did not respond correctly to the presentation of the known picture, the response was modeled by the experimenter and an imitative response was reinforced. The presentation method for these reinforced trials was also alternated between simultaneous and individual presentation.

Imitation assessment

During assessments to determine whether the children could imitate the picture names, each picture card which the child did not name correctly on the four naming assessment trials were presented randomly three times. On each trial, the experimenter modeled the response (without

presenting the picture card) and required the child to imitate the response. Thus, the experimenter said "[Name], say cherry." and a correct response consisted of the child emitting the response "cherry". Multi-syllable words were broken into their syllables for presentation during imitation assessment. Trial and intertrial intervals were identical to that for assessing naming responses.

During imitation assessments every fifth trial consisted of modeling a known word. Praise and edibles were presented to the child after correct imitation of the model to maintain general attending and responding.

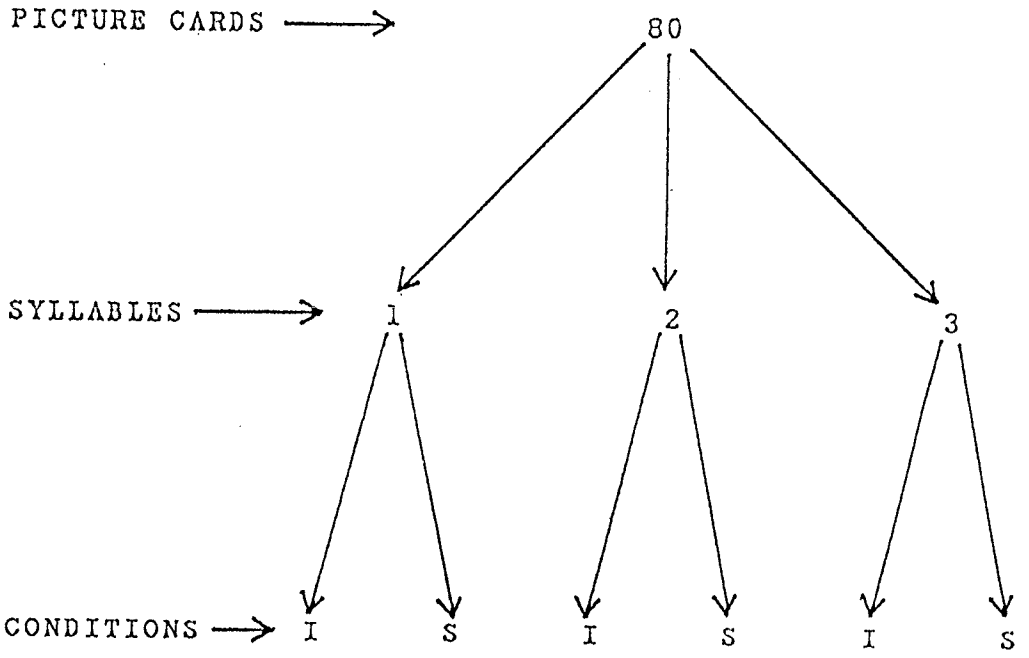
Picture Selection Procedure

Picture cards which the child failed to name on all four trials during the naming assessment but which the child imitated on all three trials during the imitation assessment were categorized as "unknown" picture cards. Picture cards which the child named on all four trials during the naming assessment were categorized as "known" picture cards. Approximately 80 unknown picture cards were identified for training for each child and approximately 24 known picture cards to be interspersed during training were chosen for each child (described later).

The 80 unknown picture cards were divided into groups of one-, two-, and three-syllable words, and each group was divided randomly into two subgroups (see Figure 1). One subgroup was trained using the simultaneous presentation procedure and the other subgroup was trained using the individual presentation procedure. Within each condition words were trained in three phases in increasing order of word complexity (one-, two-, and then three-syllables). The 24 known pictures assigned to conditions and interspersed during training were also divided into groups of one-, two-, and three-syllable words; and each group was divided randomly into two subgroups, each of which was randomly assigned to conditions. Within each condition the known pictures to be interspersed during each phase also had the same number of syllables as the ones being trained.

In addition, two unknown picture cards were randomly chosen from each of the two pools as control words. These cards were not trained, but were randomly interspersed during retention and generalization testing (described later) to ensure that the child had not acquired a large picture naming repertoire in another setting over the course of the study.

Figure 1. A schematic representation of the division of picture cards to be trained into 1, 2, and 3 syllable words and into training conditions is presented.


PICTURE CARDS
80
SYLLABLES
1
2
3
CONDITIONS
I
S
I
S
I
S

General Training Procedures

Each child received two sessions of 50 trials each per day, five days per week. The two sessions were separated by a 10 minute break. Two types of trials were presented during training: prompt and probe trials. A prompt trial consisted of the trainer presenting the picture card(s) on the table in front of the child, pointing to it, and saying "[Name], say [object name].". The child was required to imitate the response. Each correct response to a prompt was consequated with praise and every fifth correct response with edibles. A probe trial consisted of the trainer presenting the picture card(s), pointing to it, and saying "[Name], What's this?". Each correct response, which consisted of the child naming the picture presented, was consequated with edibles and praise. Olenick and Pear, (1980) demonstrated that this type of differential reinforcement schedule to prompt and probe trials facilitated verbal training. Each trial was terminated after the child had emitted a correct or incorrect response (including omissions), or after eight seconds with no response (whichever occurred first). Each trial was followed by a five second intertrial interval.

When an unknown picture was initially introduced for training, three probe trials were conducted to ensure that the child had not learned it prior to training. The

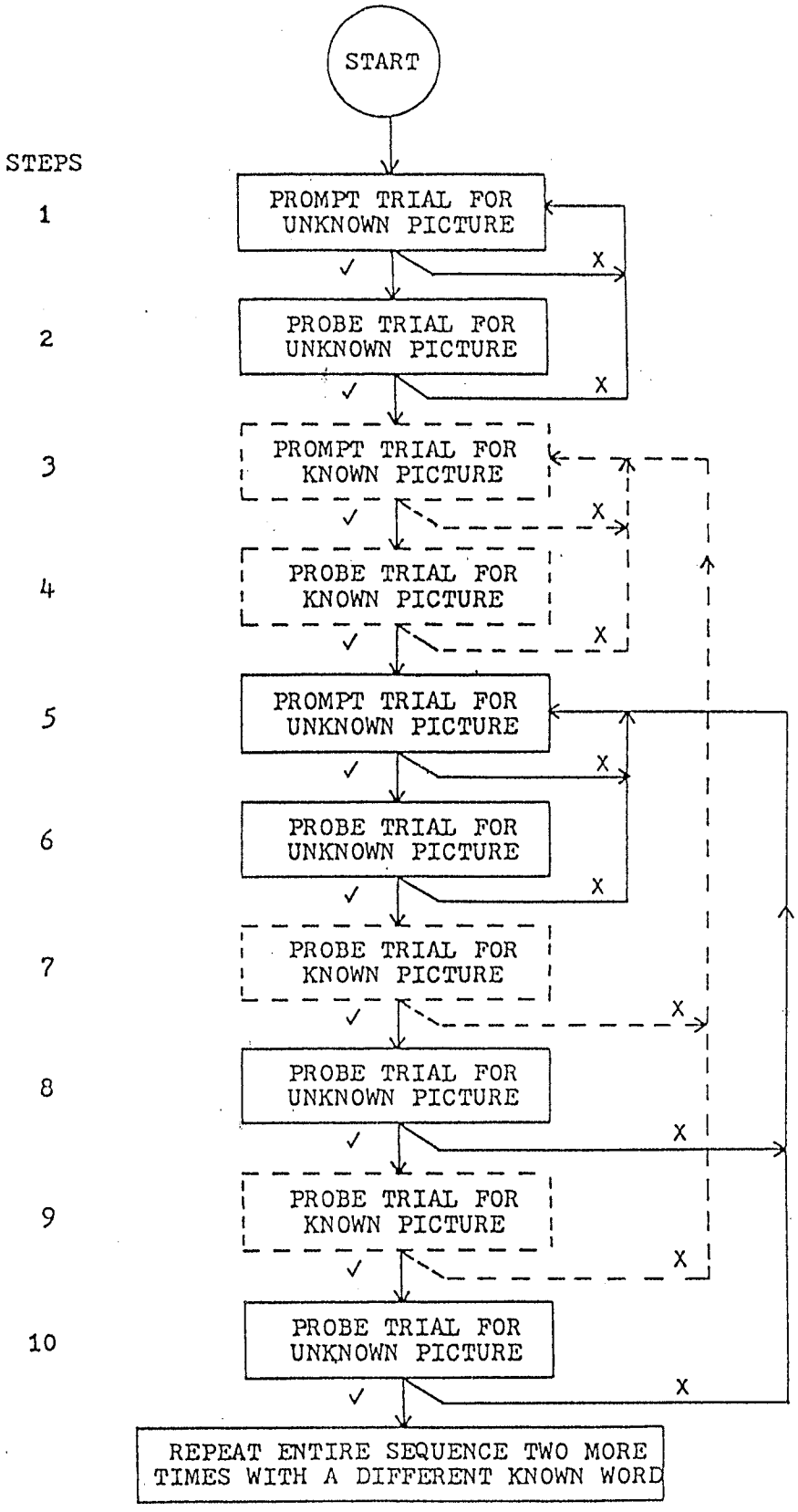
picture card was trained only if the child responded incorrectly on all three probe trials; otherwise, it was discarded and replaced with a different picture card to be trained.

Interspersal Picture Naming Procedure

The interspersal procedure was similar to procedures used by Stephens, Pear, Wray & Jackson (1975) and Olenick & Pear (1980). It was implemented in both the individual presentation and in the simultaneous presentation conditions (see Figure 2). The procedure consisted of interspersing trials for a known picture card between trials for an unknown picture card. Both picture cards went through a systematic training sequence of probe and prompt trials which consisted of a series of 10 steps. The entire sequence was completed three times in order for the unknown picture to reach criterion and to be considered learned. For each of the three sequences a different randomly selected known picture card was used for interspersing.

Training began with a prompt trial for the unknown picture card. If the child responded incorrectly the prompt trial was repeated until a correct imitative response occurred (see step 1 in Figure 2). At this point

Figure 2. A schematic representation of the interspersal training procedure. A check indicates a correct response an X indicates an incorrect response (including omissions).


START
STEPS
1
PROMPT TRIAL FOR UNKNOWN PICTURE
2
PROBE TRIAL FOR UNKNOWN PICTURE
3
PROMPT TRIAL FOR KNOWN PICTURE
4
PROBE TRIAL FOR KNOWN PICTURE
5
PROMPT TRIAL FOR UNKNOWN PICTURE
6
PROBE TRIAL FOR UNKNOWN PICTURE
7
PROBE TRIAL FOR KNOWN PICTURE
8
PROBE TRIAL FOR UNKNOWN PICTURE
9
PROBE TRIAL FOR KNOWN PICTURE
10
PROBE TRIAL FOR UNKNOWN PICTURE
✓
X
REPEAT ENTIRE SEQUENCE TWO MORE TIMES WITH A DIFFERENT KNOWN WORD

a probe trial for the unknown picture card was presented. If an incorrect response occurred, the trainer returned to step 1 and repeated the procedure as before (see step 2 in Figure 2). When a correct response occurred on the probe trial at step 2 for the unknown picture card, a prompt trial for the known picture card was presented (see step 3). Steps 3 and 4 are identical to steps 1 and 2, except that the trials were presented for the known picture card. After a correct response on step 4, the unknown picture card was presented at step 5. The procedures for steps 5 and 6 are identical to steps 1 and 2. Thereafter, steps 7 through 10 consisted of alternate probe trials for the known and unknown picture cards. If, during steps 7 through 10, an incorrect response occurred then the trainer returned to step 3 or step 5 depending on the step at which the error was made (ie. whether the error occurred for the known or unknown picture card). Training continued until the entire sequence (steps 1 to 10) had been completed three times. The unknown picture was then considered to have reached criterion and was considered to be learned. If a picture card did not reach criterion for an unknown picture being trained after six sessions or if the child responded incorrectly to the unknown or known picture card for 10 consecutive prompt trials, that picture card was discarded and another was selected for training or interspersing.

Individual Presentation

During this condition the known and unknown picture cards were presented individually according to the interspersal procedure. On each trial, the appropriate picture card was placed on the table in front of the child and the trainer pointed to the center of the top of the card.

Simultaneous Presentation

On each trial of this training condition both the unknown and known picture cards were placed face up on the table at the same time in front of the child. The trainer then pointed to either the known or unknown picture card according to the interspersal procedure previously described and always pointed to the center of the top of the picture card. The left-right position of the known and unknown picture cards was alternated across trials according to a pre-determined, randomized order.

Retention Tests

A retention test combining all words learned in both conditions was conducted bi-weekly for all words learned during this two week period. A number of known picture

cards, equal to approximately 25% of the words to be tested, was randomly chosen and interspersed between trials for the unknown picture cards. These known words coresponded in syllable complexity to the words being tested. Each correct response to known picture cards was reinforced with edibles and praise. Two control picture cards (unknown pictures which were not trained) were also randomly interspersed. No consequence was given for responses (correct or incorrect) to the control picture cards or to the unknown picture cards previously learned. During a retention test all trials consisted of probe trials presented in an identical manner to the naming baseline and all retention tests were conducted in the training room. Thus, each picture card learned was tested twice using a simultaneous presentation method and twice using an individual presentation method.

Generalization Tests

A generalization test of naming responses was conducted by another individual and in another setting after each retention test (on the same day). All picture names tested in retention were presented in the generalization test. The generalization testing procedure was identical to that implemented for retention tests with two exceptions. First, the test was conducted by a person other than the trainer who did not know in which condition

each word was learned. Second, the tests were conducted in the library room of the Psychology Department.

Dependent Variables

For learning, the major dependent variables included correct responses to prompt and probe trials for known and unknown picture cards, average number of trials to reach criterion, the average amount of time to reach criterion, and the cumulative number of picture names learned per session in each training condition. For retention and generalization tests the dependent variable was the number of previously unknown, trained picture cards correctly named in each condition.

With the multi-element design, comparisions were made across training conditions for each dependent variable within each subject as well as across subjects. Similar experimental effects observed across subjects increases confidence in drawing conclusions concerning the effects of the two training conditions on responses.

Interobserver Reliability

Twenty percent of the sessions for training (both conditions) were randomly selected and all assessment sessions, and retention and generalization test sessions

were randomly selected and audiotaped for reliability checks. An independent observer, trained on the procedure and the criteria for correct and incorrect responses, scored the child's responses by listening to the tapes. Interobserver reliability was calculated using the formula: number of agreements divided by the number of agreements plus disagreements X 100 to produce a percentage score. The trainer was the primary observer in this study.

Procedural Reliability

Twenty percent of the training sessions (both conditions) were randomly selected and videotaped for procedural reliability checks. In addition, all assessment sessions (except in the case of Diane where there was equipment failure) and all retention tests were videotaped for procedural reliability checks. An independent observer, trained on the procedures for both conditions and for the tests, scored the following categories of the experimenter's behaviour on each trial: (a) appropriate picture presentation for the training condition - simultaneous or individual; (b) trainer pointing to the correct picture; (c) correct presentation of probe or prompt trials; (d) delivery of primary and social reinforcement following correct responses to probes; (e) delivery of primary and social reinforcement following correct responses to prompts; and (f) introduction of a new

picture according to the discard criteria for known and unknown picture cards. Procedural reliability was calculated using the formula: number of agreements divided by the number of agreements plus disagreements X 100 to produce a percentage score. The trainer was the primary observer.

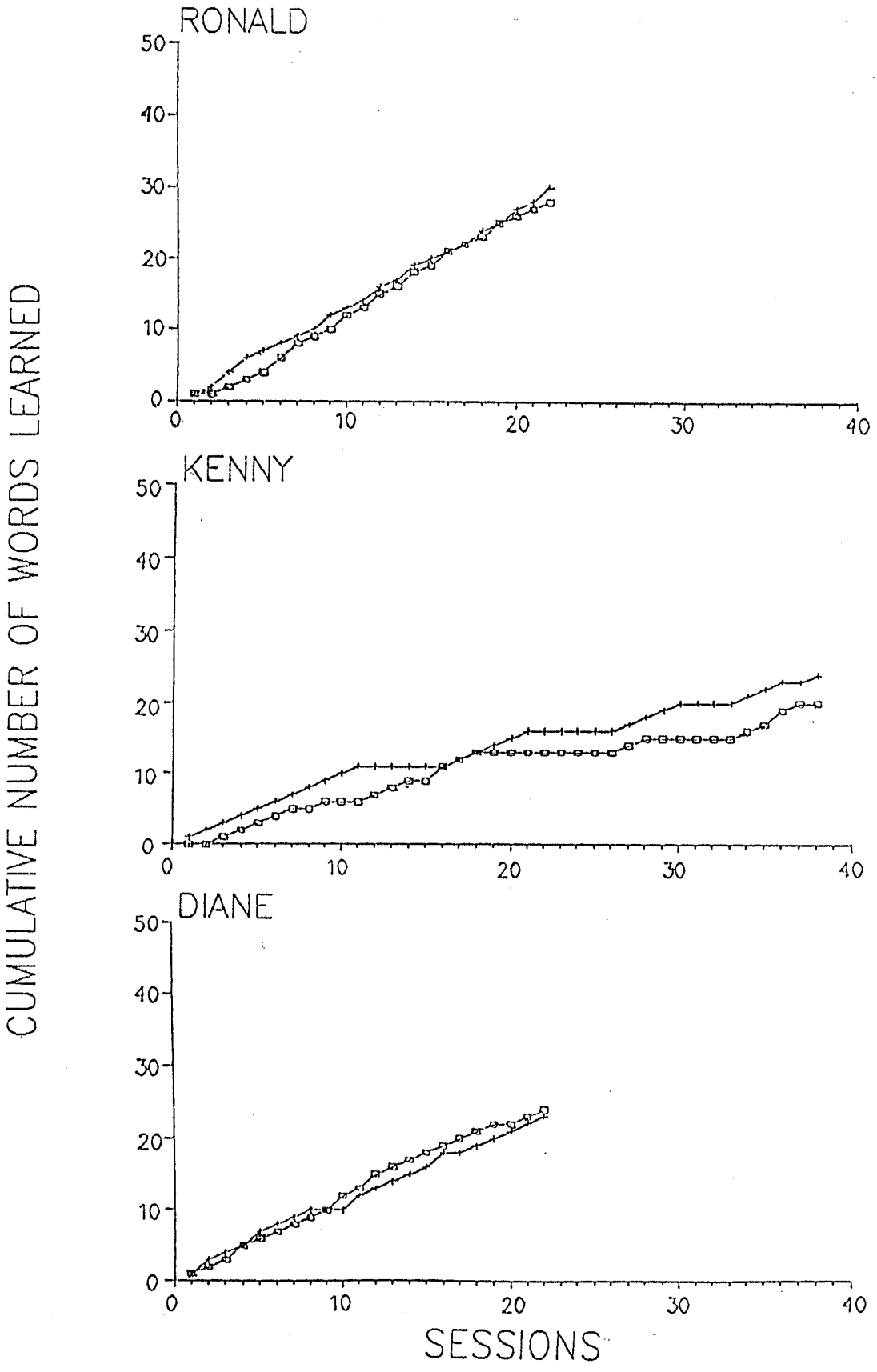
RESULTS

Training Results

The cumulative number of picture names learned by each child over all experimental sessions in both conditions is depicted in Figure 3. The total number of picture names learned over all sessions varied for each child. In addition, of the total number of picture names learned, there is little, if any, difference in the number of picture names learned in each condition for each child. The simultaneous training condition appeared to generate a slightly higher acquisition rate than the individual condition for Kenny. However, this was not the case for the other two children.

Prompt and probe accuracy for the known and unknown picture cards was calculated as a percentage of the total number of correct responses on prompt trials or on probe trials divided by the total number of prompt trials or probe trials presented. In some sessions prompt trials or probe trials for the known or unknown picture card were not presented (open spaces on the graph) due to the response pattern of the child. For example, if the child continued to respond incorrectly alternately to prompt and

Figure 3. The cumulative number of picture names learned by each child over all experimental sessions in the individual and simultaneous conditions is presented. The individual condition is depicted by an open square and the simultaneous condition is depicted by a cross.


RONALD
KENNY
DIANE
CUMULATIVE NUMBER OF WORDS LEARNED
SESSIONS
0
10
20
30
40
50

probe trials for an unknown picture card prompt and probe trials for a known picture card may not have occurred during that session. Note that this did occur in some sessions for both conditions for Kenny for prompt and probe trials to known picture cards (Figures 6 and 7).

Percent prompt accuracy to the unknown picture cards is presented in Figure 4. For all three children there is no overall difference in prompt accuracy between the two conditions. In addition, for two children, Kenny and Diane, there is considerable variability in these data. Similar results occurred for probe accuracy to unknown picture cards, presented in Figure 5. Again, there was no clear difference between the two training conditions for probe accuracy. Considerable variability in the data occurred for Kenny and Diane.

Percent prompt accuracy to the known picture card for all three children is presented in Figure 6. There was no difference in the two conditions for any of the three children. Diane's data were slightly more variable than those of Ronald or Kenny. During sessions with Kenny prompt trials were sometimes not presented as previously described. Percent probe accuracy for the known picture card for all three children is presented in Figure 7. Although there is some variability in the data, no clear differences between the two conditions were apparent for

Figure 4. Prompt accuracy for the unknown picture cards is expressed as the percentage of correct responses divided by the total number of trials. Prompt accuracy is depicted here for all three children across sessions for both conditions. The individual condition is depicted by an open square and the simultaneous condition by a cross.

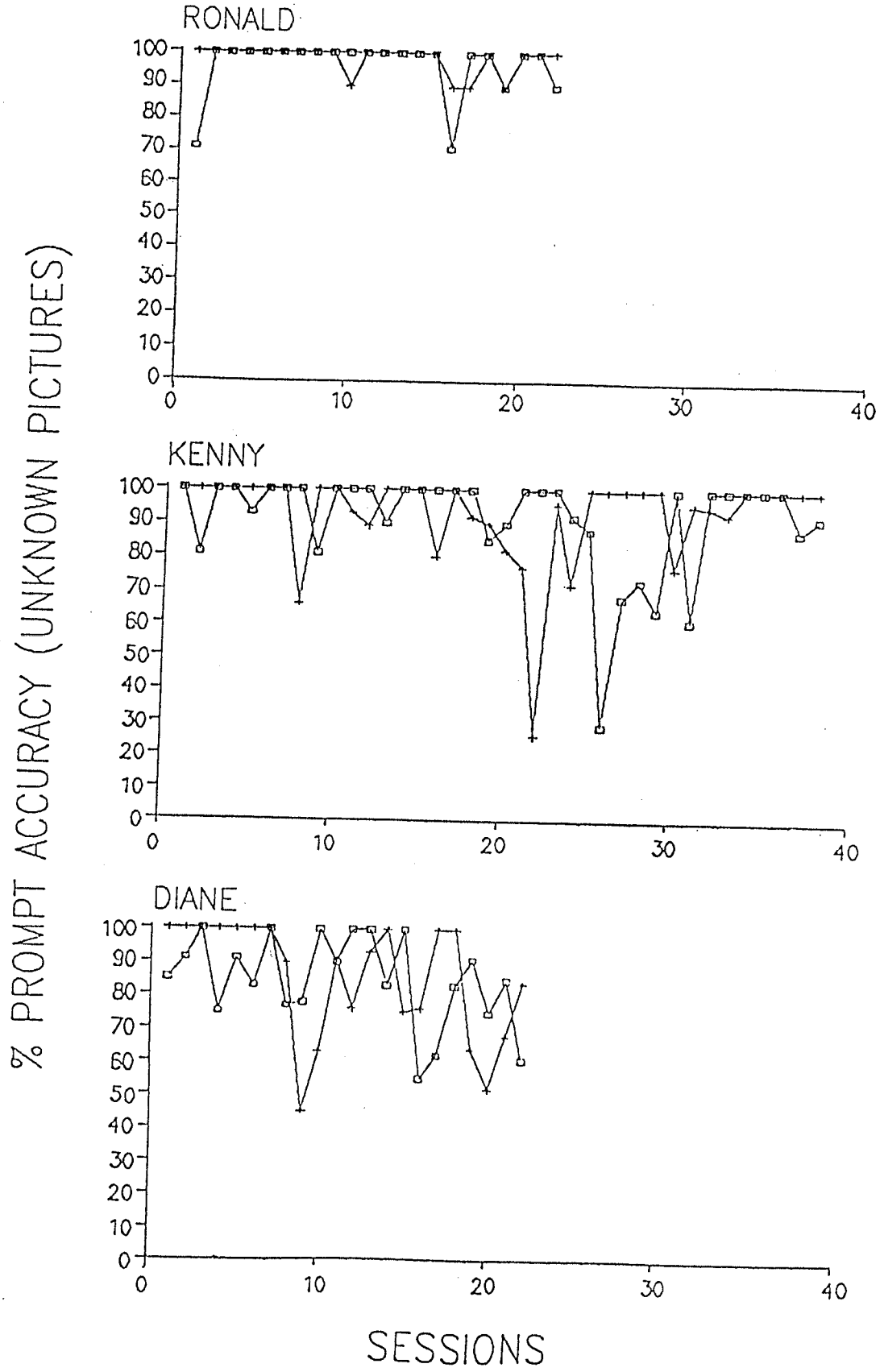

RONALD
KENNY
DIANE
% PROMPT ACCURACY (UNKNOWN PICTURES)
SESSIONS
0
10
20
30
40
50
60
70
80
90
100

Figure 5. Probe accuracy for the unknown picture cards is expressed as the percentage of correct responses divided by the total number of trials. Probe accuracy is depicted here for all three children across sessions for both conditions. The individual condition is depicted by an open square and the simultaneous condition by a cross.

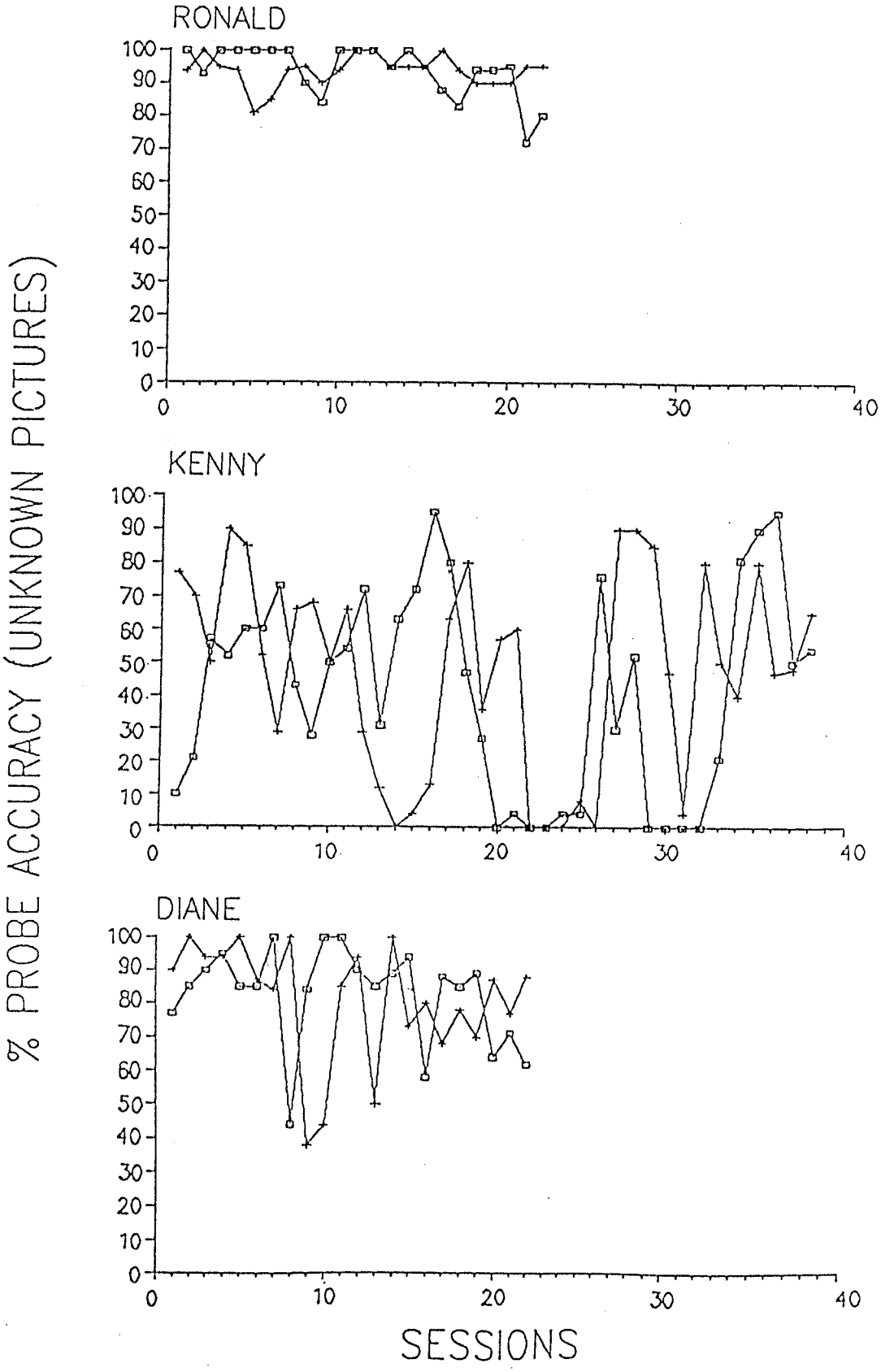

RONALD
KENNY
DIANE
% PROBE ACCURACY (UNKNOWN PICTURES)
SESSIONS
0
10
20
30
40
50
60
70
80
90
100

Figure 6. Prompt accuracy for the known picture card is expressed as the percentage of correct responses divided by the total number of trials. Prompt accuracy is depicted here for all three children across sessions for both conditions. The individual condition is depicted by an open square and the simultaneous is depicted by a cross.

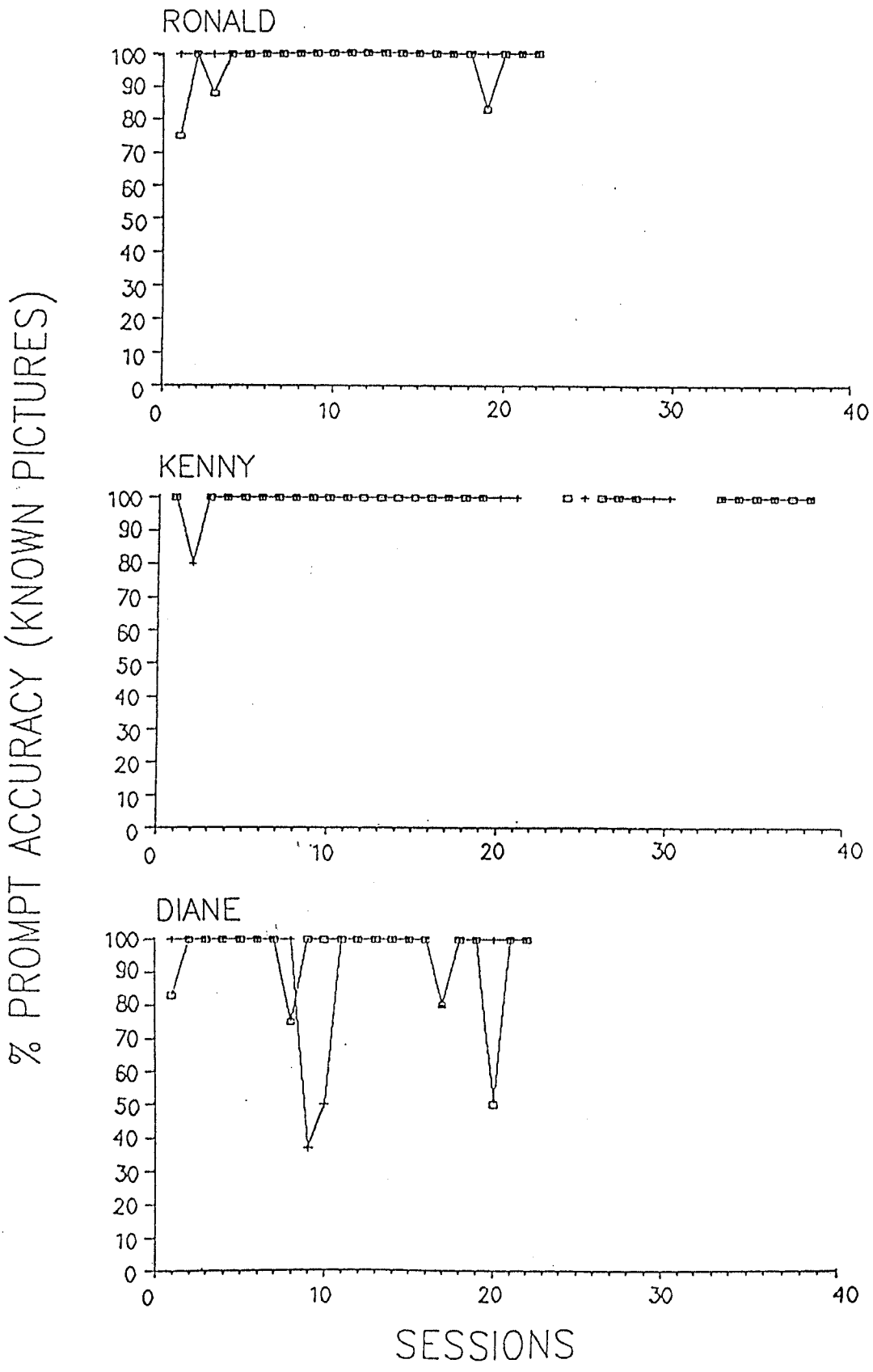
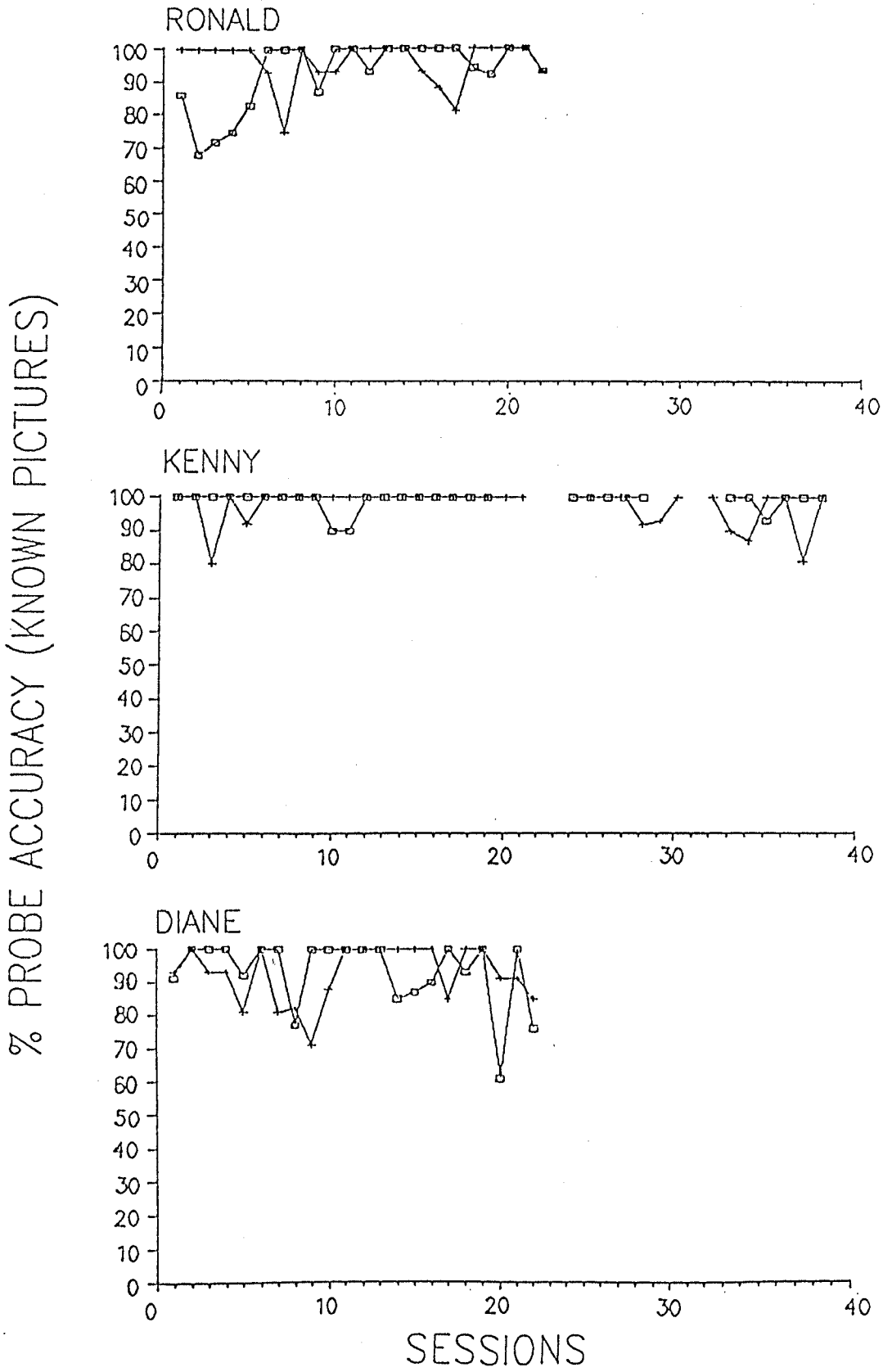

RONALD
KENNY
DIANE
% PROMPT ACCURACY (KNOWN PICTURES)
SESSIONS
0
10
20
30
40
50
60
70
80
90
100

Figure 7. Probe accuracy for the known picture card is expressed as the percentage of correct responses divided by the total number of trials. Probe accuracy is depicted here for all three children across sessions for both conditions. The individual condition is depicted by an open square and the simultaneous condition by a cross.


RONALD
KENNY
DIANE
% PROBE ACCURACY (KNOWN PICTURES)
SESSIONS
0
10
20
30
40
50
60
70
80
90
100

any of the three children. For Kenny, as occurred during prompt trials, probe trials were not presented in all sessions for the known picture card.

The number of picture cards replaced in each condition for each child is depicted in Table 5. A greater number of picture cards were replaced for Kenny and Diane in both conditions than for Ronald. A greater number of picture cards were replaced in the individual condition than in the simultaneous condition for Kenny, the only child who required picture cards to be replaced according to the discard criterion.

The average amount of time per session (in minutes) for both conditions is presented in Table 6. Sessions in the simultaneous condition required a slightly greater amount of time to conduct (a minute or less) than individual condition sessions. This difference is consistent across all three children.

The average number of trials for picture cards to reach criterion in both conditions is presented in Table 7. For Ronald and Kenny fewer trials were required for picture cards to reach criterion in the simultaneous condition. For Diane, fewer trials were required in the individual condition. For two children, Ronald and Diane, the

Table 5.

Number of Picture Cards Replaced in Each Condition

	CONDITION						
	INDIVIDUAL			SIMULTANEOUS			
CHILD	KNOWN ON PROBE	DISCARD CRITERION	TOTAL	KNOWN ON PROBE	DISCARD CRITERION	TOTAL	OVERALL TOTAL
RONALD	2	0	2	1	0	1	3
KENNY	4	4	8	3	2	5	13
DIANE	3	0	3	5	0	5	8

Table 6.

Average Time (in Minutes) for Each 50 Trial Session for Each Condition

	CONDITION	
CHILD	INDIVIDUAL	SIMULTANEOUS
RONALD	9.9 MIN.	10.8 MIN.
KENNY	8.8 MIN.	9.3 MIN.
DIANE	9.0 MIN.	10.3 MIN.

Table 7.

Average Number of Trials to Reach Criterion

	CONDITION	
CHILD	INDIVIDUAL	SIMULTANEOUS
RONALD	39.20	36.60
KENNY	100.00	79.10
DIANE	45.80	50.00

difference in the number of trials to reach criterion between the two conditions was small.

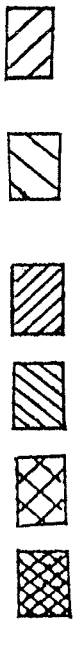
Retention and Generalization Results

Picture cards were trained presenting stimuli individually or trained presenting stimuli simultaneously. During retention and generalization tests all picture cards learned during training were presented individually on two trials and simultaneously (with a known picture card) on two trials each (see Table 4). The percent of picture names retained and generalized on bi-weekly tests with respect to whether training was individual or simultaneous and whether testing was individual or simultaneous is presented in Figure 8. In addition, Figure 8 depicts the results when all four test trials (two individual and two simultaneous trials) were combined. It also presents the data when the test trials were separated into individual presentation on tests and simultaneous presentation on tests (two trials each).

Retention and generalization results - all trials

Generally, when all four test trials were combined, overall retention and generalization percentages were low for Kenny and Diane. However, a greater percentage of picture cards trained individually were retained than

Figure 8. The percentage of picture names retained and generalized out of the total number of picture names trained for all three children in all testing conditions is presented. Training conditions and testing conditions are depicted by each bar on the graph as follows:



-individually trained: combined individual and simultaneous. test trials.

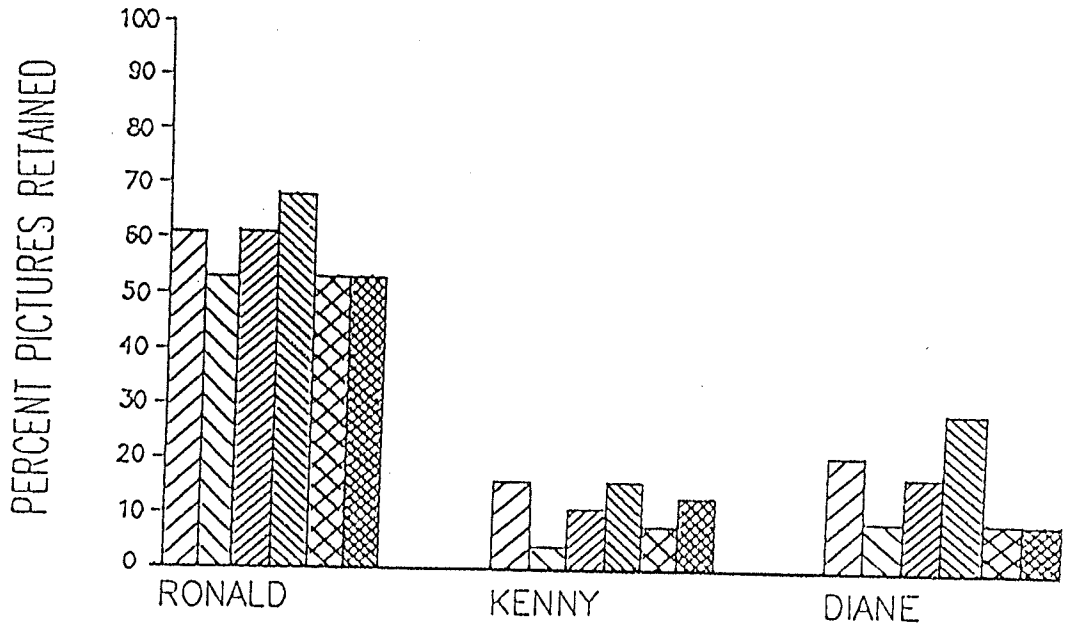
-simultaneously trained: combined individual and simultaneous test trials.

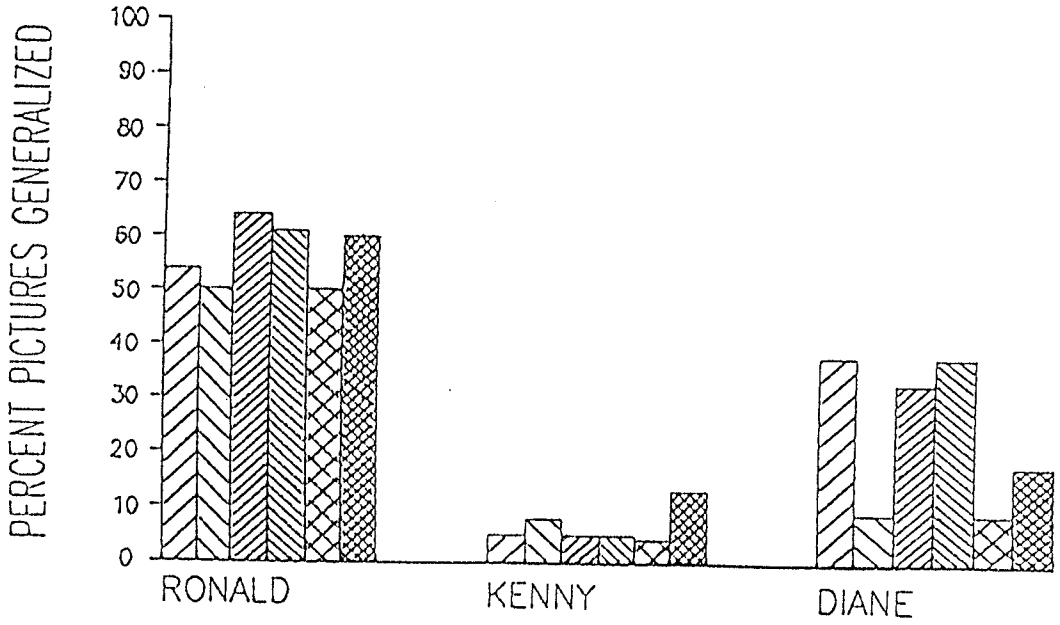
-trained individually: tested individually.

-trained individually: tested simultaneously.

-trained simultaneously: tested individually.

-trained simultaneously: tested simultaneously.


PERCENT PICTURES RETAINED
100
90
80
70
60
50
40
30
20
10
0
RONALD
KENNY
DIANE


PERCENT PICTURES GENERALIZED
100
90
80
70
60
50
40
30
20
10
0
RONALD
KENNY
DIANE

those picture cards trained simultaneously. These results were consistent for all three children on retention tests and resulted in differences ranging from eight to 12 percent of the words retained.

Similar results occurred in generalization tests for Ronald and Diane in that a greater percentage of picture names trained individually were retained than those trained simultaneously. These differences ranged from four to 29 percent of words generalized. For Kenny however, a greater percentage of picture names trained simultaneously than trained individually, generalized. The difference in the percent of picture names generalized was only three percent.

Correct responses were not emitted on any trials to the control words presented on any retention or generalization tests for either of the two conditions. This was consistent for all three children.

Retention and generalization results - separated test trials

Training conditions and testing conditions (two trials each) were then separated out into categories of (a) individual presentation of stimuli during training and testing, (b) individual presentation of stimuli during

training and simultaneous presentation during testing, (c) simultaneous presentation of stimuli during training and individual presentation during testing, and (d) simultaneous presentation of stimuli during training and testing. (see Figure 8.).

Retention

When training conditions and testing conditions were separated in this way, a greater percentage of picture names were retained when trained in the individual condition but tested by simultaneously presenting two stimuli at the same time (category b above) than in any other combination. These results were consistent across all three children and the differences ranged from three to 14 percent difference in the percent of words retained from the next most effecient combination of training and testing conditions.

For Ronald and Diane the next most effective combination involved picture names both trained and tested using the individual presentation of stimuli (category a above). For Kenny the next most effective combination for increasing retention involved picture cards trained and tested using the simultaneous presentation of stimuli (category d above).

Overall the most effective combination of training and testing methods for increasing retention consisted of presenting stimuli individually during training and presenting both training stimuli simultaneously during testing. The next most effective method for enhancing retention would appear to be of keeping the method of presenting stimuli consistent during training and testing, whether that consisted of presenting stimuli individually or simultaneously. This varied between children.

Generalization

Results were considerably more variable for generalization of picture names in that there was not one particular training and testing combination that was consistently effective across all three children (see Figure 8). Diane's generalization results were consistent with retention results in that a greater percentage of picture names were retained when trained by presenting stimuli individually and tested by presenting stimuli simultaneously. Similarly, the next most efficient method for enhancing generalization also occurred when picture names were both trained and tested by presenting stimuli individually.

For Ronald and Kenny generalization results were not consistent with retention results nor were they consistent

between the two children. For Ronald the most effective method for enhancing generalization consisted of both training and testing picture names by presenting stimuli individually while for Kenny generalization was enhanced when words were both trained and tested by presenting stimuli simultaneously.

Retention and Generalization of Names Learned on First or Second Week

Picture names learned during the second week of training may be more easily retained and generalized than those learned during the first week of training, since they are closer to these tests in time. Table 8 summarizes retention and generalization of picture names learned during the first week of training vs picture names learned during the second week of training. Since there were occasions (sickness, home visits, etc.) where some sessions were missed for each child, only results in which there were an equal number of sessions in the first week of training as in the second week of training were included.

In general, picture names trained simultaneously during the first week were retained better for two children while picture names trained individually in the second week

Table 8.

A Summary of Retention and Generalization of Picture Cards Learned During the First Week of Training vs Picture Cards Learned During the Second Week of Training on Bi-weekly Tests

		RETENTION						GENERALIZATION					
		TEST CONDITION						TEST CONDITION					
		INDIVIDUAL AND SIMULTANEOUS TEST RESULTS (COMBINED)		TESTED INDIVIDUALLY		TESTED SIMULTANEOUSLY		INDIVIDUAL AND SIMULTANEOUS TEST RESULTS (COMBINED)		TESTED INDIVIDUALLY		TESTED SIMULTANEOUSLY	
		FIRST WEEK	SECOND WEEK	FIRST WEEK	SECOND WEEK	FIRST WEEK	SECOND WEEK	FIRST WEEK	SECOND WEEK	FIRST WEEK	SECOND WEEK	FIRST WEEK	SECOND WEEK
CHILD	TRAINING CONDITION	4/4 TRIALS		2/2 TRIALS				4/4 TRIALS		2/2 TRIALS			
RONALD	INDIVIDUAL	10/18 (56%)	7/9 (78%)	10/18 (56%)	7/9 (78%)	12/18 (67%)	7/9 (78%)	9/18 (50%)	7/9 (78%)	11/18 (61%)	7/9 (78%)	10/18 (55%)	7/9 (78%)
	SIMULTANEOUS	11/20 (55%)	5/10 (50%)	11/20 (55%)	5/10 (50%)	11/20 (55%)	5/10 (50%)	11/20 (55%)	5/10 (50%)	10/20 (50%)	6/10 (60%)	13/20 (65%)	5/10 (50%)
KENNY	INDIVIDUAL	0/6 (0%)	0/7 (0%)	0/6 (0%)	0/7 (0%)	1/6 (17%)	0/7 (0%)	0/6 (0%)	0/7 (0%)	0/6 (0%)	0/7 (0%)	0/6 (0%)	0/7 (0%)
	SIMULTANEOUS	1/8 (13%)	0/9 (0%)	1/8 (13%)	1/9 (11%)	2/8 (25%)	0/9 (0%)	0/8 (0%)	1/9 (11%)	0/8 (0%)	1/8 (13%)	1/8 (13%)	1/9 (11%)
DIANE	INDIVIDUAL	2/10 (20%)	1/9 (11%)	2/10 (20%)	1/9 (11%)	3/10 (30%)	1/10 (10%	3/10 (30%)	3/9 (33%)	3/10 (30%)	3/9 (33%)	3/10 (30%)	3/9 (33%)
	SIMULTANEOUS	1/10 (10%)	1/9 (11%)	1/10 (10%)	1/9 (11%)	1/10 (10%)	1/9 (11%)	1/10 (1%)	1/9 (11%)	1/10 (10%)	1/9 (11%)	1/10 (10%)	3/9 (33%)

were generalized for two children. There is very little consistency in the results across children, conditions, or retention and generalization.

Ronald retained and generalized a greater percentage of picture names learned during the second week than during the first week of training, but this was mainly true for those picture names that were trained by presenting stimuli individually. For those picture names that were trained simultaneously, a slightly greater percentage of picture names learned during the first week of training were generally retained and generalized. The only exception to this was during generalization tests in which picture names were tested with an individual presentation method. In this case, a greater percentage of picture names learned during the second week than during the first week of training were generalized.

For Kenny, where there were any differences for retention and generalization between picture names learned during the first week and those learned during the second week of training, a greater percentage of words learned during the first week than during the second week were retained. This occurred for picture names learned with both individual and simultaneous stimulus presentation. Generalization results were the opposite in that, overall, a greater percentage of picture names learned during the

second week than during the first week of training generalized. This occurred for picture names trained by presenting stimuli simultaneously. One exception was for picture names tested simultaneously where a slightly greater percentage of picture names learned during the first week than during the second week of training, generalized. It is difficult to compare differences in retention and generalization for those words learned during the first and second weeks of training for those picture names that were trained by individually presenting stimuli since it appears that so few picture names were retained or generalized.

Diane's data indicate that a greater percentage of words learned during the first week than during the second week of training were retained; however, this only occurred for those picture names trained by presenting stimuli individually. The opposite occurred for words learned by presenting stimuli simultaneously where a slightly greater percentage of words learned during the second week than during the first week of training were retained. Similarly, during generalization, a slightly greater percentage of words learned during the second week than during the first week of training generalized. This occurred for picture names learned by individually or simultaneously presenting stimuli during training.

Retention and Generalization Results for Fewer Test Trials

Each child had to respond correctly on all four test trials for a picture name to be considered retained or generalized. This may be a stringent criterion. Cuvo et al. (1980) conducted more than four test trials during retention tests. However, tests occurred immediately after training. Rowan & Pear (1985) conducted fewer than four trials when tests occurred after a longer period of time after training. Results may vary in the present study if fewer than four test trials are considered. The percent of picture names retained and generalized on both one out of four trials correct and four out of four trials correct when picture names were tested using a combination of individually and simultaneously presenting stimuli two times each is summarized in Table 9. It also contains a summary of the percent of picture names retained when testing conditions are separated into individual and simultaneous trials for both one out of two trials correct and two out of two trials correct for each testing method.

Percentage of picture names retained and generalized are slightly lower when considering four out of four trials correct than when considering one out of four trials correct, when the test trials are a combination of the individual and simultaneous presentation of stimuli. Similar results occur when considering two out of two

Table 9.

A Summary of the Number of Picture Names
Retained and Generalized

			RETENTION						GENERALIZATION					
			TEST CONDITION						TEST CONDITION					
			INDIVIDUAL AND SIMULTANEOUS TEST RESULTS (COMBINED)		TESTED INDIVIDUALLY		TESTED SIMULTANEOUSLY		INDIVIDUAL AND SIMULTANEOUS TEST RESULTS COMBINED		TESTED INDIVIDUALLY		TESTED SIMULTANEOUSLY	
CHILD	TRAINING CONDITION	TOTAL PICTURES TESTED	1/4 TRIALS	4/4 TRIALS	1/2 TRIALS	2/2 TRIALS	1/2 TRIALS	2/2 TRIALS	1/4 TRIALS	4/4 TRIALS	1/2 TRIALS	2/2 TRIALS	1/2 TRIALS	2/2 TRIALS
RONALD	INDIVIDUAL	28	21 (75%)	17 (61%)	20 (71%)	17 (61%)	20 (71%)	19 (68%)	22 (79%)	15 (54%)	21(75%)	18 (64%)	22 (79%)	17 (61%)
	SIMULTANEOUS	30	21 (70%)	16 (53%)	20 (67%)	16 (53%)	21 (70%)	16 (53%)	20 (67%)	15 (50%)	17 (57%)	15 (50%)	20 (67%)	18 (60%)
KENNY	INDIVIDUAL	19	5 (26%)	3 (16%)	4 (21%)	2 (11%)	4 (21%)	3 (16%)	3 (16%)	1 (5%)	3 (16%)	1 (5%)	2 (11%)	1 (5%)
	SIMULTANEOUS	24	5 (21%)	1 (4%)	2 (8%)	2 (8%)	5 (21%)	3 (13%)	8 (33%)	2 (8%)	5 (21%)	1 (4%)	6 (25%)	3 (13%)
DIANE	INDIVIDUAL	24	9 (38%)	5 (21%)	8 (33%)	4 (17%)	8 (33%)	7 (29%)	9 (38%)	9 (38%)	9 (38%)	8 (33%)	9 (38%)	9 (38%)
	SIMULTANEOUS	22	4 (18%)	2 (9%)	2 (9%)	2 (9%)	4 (18%)	2 (9%)	5 (23%)	2 (9%)	4 (18%)	2 (9%)	5 (23%)	4 (18%)

trials correct and one out of two trials correct, when the test trials are separated into individual or simultaneous presentation of stimuli.

Retention and Generalization Results for First Test Trial

During retention and generalization tests each picture name learned was tested four times. The method of presenting stimuli (individually or simultaneously) for the first test trial for each picture card was randomized. Results may vary depending on whether the first test trial consisted of individual or simultaneous presentation of stimuli. In order to determine how the children responded on the first test trial specific to a particular condition, only the first test trial specific to each conditon was considered. This would eliminate any possible confounding that might occur because of having had test trials for the other condition first. The percentage of picture names retained and generalized on the first trial when presented individually and the percentage of picture names retained and generalized on the first trial when presented simultaneously is summarized in Table 10.

In general, higher retention was obtained for those picture names in the simultaneous test condition for two children. Better generalization was suggested for picture

Table 10.

Number of Picture Names Retained and Generalized on First Trial of Individual and Simultaneous Test for Each Condition for Each Child

		RETENTION		GENERALIZATION	
CHILD	TRAINING CONDITION	TESTED INDIVIDUALLY FIRST	TESTED SIMULTANEOUSLY FIRST	TESTED INDIVIDUALLY FIRST	TESTED SIMULTANEOUSLY FIRST
RONALD	I	8/14 (57%)	1/14 (7%)	9/14 (64%)	12/14 (86%)
	S	10/17 (58%)	10/13 (77%)	8/17 (47%)	10/13 (77%)
KENNY	I	3/11 (27%)	0/9 (0%)	2/11 (18%)	0/9 (0%)
	S	2/14 (14%)	1/10 (10%)	3/14 (21%)	2/10 (20%)
DIANE	I	4/18 (22%)	2/6 (33%)	6/18 (75%)	3/6 (50%)
	S	1/10 (10%)	3/12 (25%)	4/11 (36%)	0/12 (0%)

names in the individual test condition for two children. Results were not consistent across children, or across retention and generalization; however, only one trial was considered in these results.

For Ronald, a greater percentage of picture names were retained and generalized when tested simultaneously first. The exception was for picture names trained individually where a greater percentage of picture names were retained when tested individually first. For Kenny, a greater percentage of picture names were retained and generalized when tested individually first. For Diane, a greater percentage of picture names were retained when tested simultaneously first. The opposite occurred during generalization where a greater percentage of picture names generalized that were tested individually first. The above results occurred for all three children regardless of whether picture names were trained individually or simultaneously.

Interobserver and Procedural Reliability Results

Interobserver reliability percentages for each of the three children for verbal responses during baseline assessments, training (individual and simultaneous), and retention and generalization tests is presented in Table 11. These results ranged from 92-100%.

Table 11.

Interobserver Reliability Results

		TRAINING CONDITION		TESTING CONDITION	
CHILD	BASELINE	INDIVIDUAL	SIMULTANEOUS	RETENTION	GENERALIZATION
RONALD	100%	99%	99%	99%	99%
KENNY	100%	98%	98%	100%	99%
DIANE	100%	98%	92%	100%	100%

Procedural reliability percentages for each of the three children for baseline, training (individual and simultaneous), and retention tests is depicted in Table 12. The following categories were included: (a) correct method of presenting the stimulus for the training condition, (b) correct picture card pointed to, (c) presenting the picture card correctly on the left or right, (d) presenting a prompt or probe trial in accordance with the training sequence, (e) presenting primary reinforcement after each probe trial, (f) presenting social reinforcement after each probe trial, (g) presenting primary reinforcement after every fifth prompt trial, (h) presenting social reinforcement after each prompt trial and, (i) introducing a new picture card in accordance with the discard criterion. Procedural reliability results are not available for generalization tests since it was not possible to videotape in that setting.

Procedural reliability results across all above mentioned categories across all children during assessment was 100% (note that for Diane procedural reliability measures were not possible during assessment due to a video equipment failure); during the individual condition ranged from 97.5% to 100%; during the simultaneous condition ranged from 98.3% to 100%; and during retention was 100%.

Table 12.

Procedural Reliability Results

	CORRECT PRESENTATION FOR CONDITION	POINT TO CORRECT CARD	I/R PRESENTATION	CORRECT PROMPT /PROBE	PRIMARY REINFORCEMENT AFTER PROBE	SOCIAL REINFORCEMENT AFTER PROBE	PRIMARY REINFORCEMENT AFTER PROMPT	SOCIAL REINFORCEMENT AFTER PROMPT	INTRODUCTION OF NEW PICTURE RE: CRITERION
RONALD									
BASELINE	100%	100%	100%	100%	100%	100%	100%***	100%***	N/A
IND*	100%	97.5%	N/A	99.5%	99.7%	100%	98%	100%	100%
SIM**	100%	100%	100%	100%	100%	100%	98.3%	100%	100%
RETENTION	100%	100%	100%	100%	100%	100%	100%***	100%***	N/A
KENNY									
BASELINE	100%	100%	100%	100%	100%	100%	N/A	N/A	N/A
IND	99.8%	99.6%	N/A	99.3%	99.6%	99.6%	99.6%	99.6%	100%
SIM	100%	99.4%	100%	99.7%	100%	100%	98.8%	98.8%	99.5%
RETENTION	100%	100%	100%	100%	100%	100%	N/A	N/A	N/A
DIANE									
BASELINE	(EQUIPMENT FAILURE)			-	-	-	N/A	N/A	N/A
IND	100%	100%	N/A	100%	100%	100%	100%	100%	100%
SIM	100%	100%	100%	98.6%	100%	100%	100%	100%	100%
RETENTION	100%	100%	100%	100%	100%	100%	N/A	N/A	N/A

*IND = INDIVIDUAL PRESENTATION
**SIM = SIMULTANEOUS PRESENTATION

***only Ronald required prompts for the known picture card during baseline and retention tests.

DISCUSSION

In summary, the results indicate that both interspersal and simultaneous procedures are equally effective for training picture naming responses in terms of the rate of acquisition of picture names, the cumulative number of picture names learned, and the percentage of correct responses to prompt and probe trials to known and unknown picture cards. This would suggest that (a) there is no discernible difference between the two conditions in terms of the opportunity for discrimination training or (b) that a greater opportunity for discrimination training did exit in the simultaneous condition but that competing responses in this condition lessened the effect of any discrimination training that did exist, making both conditions appear equally effective.

If competing responses did lessen the effect in the simultaneous condition during training, a similar confounding effect did not seem to be apparent during retention tests. Interestingly, results for retention tests indicated that greater percentages of picture names were retained when tested simultaneously for those picture cards trained in the individual condition. These results were consistent across all three children. This suggests

that competing responses were not evident during the simultaneous test condition since retention results were higher when stimuli were presented simultaneously than when they were presented individually.

The results from generalization tests were not consistent across all three children in terms of the most effective combination of training and testing conditions. For one child, retention and generalization results were similar in that a greater percentage of picture names generalized when tested simultaneously for those cards trained in the individual condition. For the other two children, a greater percentage of picture names generalized when the training and testing conditions were the same. The specific condition varied with the child. A greater percentage of picture names generalized for one child, when trained and tested in the individual condition, and for the other child, when trained and tested in the simultaneous condition. Since two of the three children obtained higher percentages of words generalized when stimuli were presented simultaneously it would appear that competing responses were not operating during generalization tests either, at least for two of the children.

Overall results do not clearly support an assumption that greater opportunities for discrimination training occurred in the simultaneous condition since there was very

little difference in dependent measures during training for the two conditions. Furthermore, the results do not appear to consistently support an assumption that competing responses exist when stimuli are presented simultaneously. While this may have been a factor during training, it did not appear to occur during retention, since higher percentages of picture cards were retained when stimuli were presented simultaneously during these tests for picture cards trained individually.

The apparent inconsistency between the present results and those of Cuvo et al. (1980) should be addressed. In the Cuvo et al. (1980) study presenting stimuli individually was more effective than presenting stimuli simultaneously during training. In the present study, both conditions appeared equally effective during training. Cuvo et al. (1980), however, compared a concurrent procedure where two stimuli were presented simultaneously and the possibility for discrimination training could occur, to a serial procedure in which only one stimulus is presented to some mastery criterion and there is no possibility for discrimination training. Any opportunity for discrimination training may enhance learning more than no opportunity at all. The present study compared two procedures in which the possibility for discrimination training occurred in both. When there is a possibility for discrimination training in both procedures, presenting

stimuli simultaneously may not offer any improvement in the training situation over presenting stimuli individually when they are alternated across trials.

The results also seem inconsistent when retention results are considered. Cuvo et al. (1980) reported better retention for the simultaneous training condition. In the present study, retention was not greater for the simultaneous training condition. This inconsistency may be partly due to the type of instructional sequence used in each study. In an interspersal procedure, used in the present study, a known and an unknown picture card are introduced during training. In the simultaneous condition both were present. Since one response (to the known picture card) is more strongly established, it may compete with the response being learned. In a concurrent procedure, used in Cuvo et al.'s (1980) study, two unknown picture cards are introduced during training. Since one response is not more strongly established than the other, competing responses should not be present in the simultaneous condition. Training may have been more effective in the simultaneous condition of that study than in the present study due to the concurrent procedure. More effective training may have resulted in more effective retention.

Implementing a concurrent procedure, in which both stimuli are considered to be "unknown", may lessen the effect of any existing competing responses due to presenting known stimuli during training, and thus may demonstrate a more clear effect of presenting stimuli simultaneously during training. If this is the case, further research, comparing an interspersal to a concurrent procedure with simultaneous stimulus presentation in both, would seem to be indicated.

A further note in regard to inconsistencies in retention results for the simultaneous condition across the two studies concerns the amount of time between training and testing. Cuvo et al. tested for retention immediately after responses had reached acquisition. The present study tested for retention at two week intervals for all picture names learned within that time period. If a shorter time period between training and testing had occurred in the present study, retention results for the simultaneous condition may have been more consistent with that of Cuvo et al.'s.

The above issues may address inconsistencies in the present study and Cuvo et al.'s study, and may offer an account of why the individual condition was not more effective than the simultaneous condition in the present study during training and why retention was not higher for

words trained in the simultaneous condition. It does not, however, explain the fact that retention was higher in the present study when stimuli were presented simultaneously during these tests only for picture names trained individually. Apparently, presenting two stimuli simultaneously has a different effect during training than during later testing. A possible explanation may concern situational stimuli. Competing responses may not have occurred during training in the individual condition making it a more effective training procedure than the simultaneous condition. The later introduction of these additional stimuli in the simultaneous testing condition may have enhanced retention in that an additional stimulus common to both training and testing was introduced. Stokes and Baer (1977) suggest that it is important to program common stimuli which occur both in the training setting and in the generalization setting in order to increase the probability of responses occurring. Thus, the stimuli may be discriminative stimuli for responding correctly to both stimuli during testing.

Another possible explanation for the effect that retention was greater in the simultaneous test condition for picture cards trained individually could be considered. It may be that in the simultaneous condition during training there may have been competition between stimuli

which may affect whether a particular stimulus becomes a discriminative stimulus for a response; as opposed to competition between well established responses that two stimuli, already clearly established as discriminative stimuli, may occasion. Honig and Urcuioli (1981) in their review of stimulus generalization discuss possible attentional processes in terms of competition among stimuli. There may be competition between stimuli during antecedant conditions which may affect whether a particular stimulus becomes a discriminative stimulus for a response. Introducing two picture cards during the simultaneous training condition, particularly since one was a known picture card that had a prior history of reinforcement for being attended to, may have affected how much the second picture card was attended to during training. If the individual condition was a more effective training condition because of this one would expect better results in retention , particularly in the simultaneous conditon where an additional stimulus common to training was presented. If it was not attended to very well in the simultaneous condition during training , one would not expect good retention whether tested individually or simultaneously. Further support for this account lies in the fact that in the Cuvo et al. study a serial procedure with only one stimulus was more effective during training than when simultaneous stimuli were presented and a possibility of competition between stimuli might exist.

A further issue to address, which may account, in part, for the fact that the results indicate that both individually and simultaneously presenting stimuli are equally effective during training, is that of the type of experimental design chosen to study this problem. As Kazdin (1982) suggests difficulties may arise when implementing a multi-element design when there is similarity between the two procedures. If procedures in which only subtle variations occur are compared, an effect may not be apparent when implementing a multi-element design that may be apparent if procedures were compared across phases. If the opportunity for discrimination training varies only slightly in the two procedures implemented in this study, the use of a multi-element design may have resulted in a conservative effect of the comparison, thus, indicating that both procedures are equally effective during training. Further to this, Williams (1982) reported that discrimination training occurred more slowly when sessions for two different discrimination problems were alternated over days than when trials were presented for one discrimination problem on successive days and then the next discrimination problem was trained on successive days. Although in that study sessions were alternated over days rather than two sessions alternated each day, it may still be important when training several discrimination problems to present successive sessions for one problem at a time.

Overall, the results of the present study suggest that individually or simultaneously presenting stimuli during training in an applied setting (eg. school) would be equally effective for teaching picture names. Cumulative number of picture names learned, correct responses to prompt and probe trials, amount of time to conduct sessions, and number of trials to reach criterion were not significantly better in either condition. Although retention and generalization results for two children in this study were generally low, the increased results on retention tests for picture names learned in the individual condition and tested in the simultaneous conditon suggest that the individual conditon may have some small advantage over the simultaneous conditon for training.

The results of this study did not clearly substantiate the suggestion that instructional sequences could be ranked according to the amount of discrimination training that might exist due to the type of instructional sequence used (serial or interspersal and concurrent) and the method of presenting stimuli (individual or simultaneous presentation) during the instructional sequence. This would seem the case for training results, at least. However, picture cards trained individually and tested simultaneously did result in slightly higher retention for all three children, and slightly higher generalization for

one child. Further research is perhaps warranted directly comparing the three instructional sequences (serial, interspersal, and concurrent) to the two different stimulus presentation methods (individual and simultaneous). This may clarify the role of competing responses and stimuli and determine advantages that might be obtained using a concurrent instructional sequence, if any.

In conclusion, the present study investigated the effects of individual and simultaneous stimulus presentation during picture name training. While the procedures appear to be equally effective during training, retention was enhanced for picture cards trained individually and tested simultaneously. These results cannot be fully explained by differing amounts of discrimination training in each condition or through competing responses. Additional factors which might be considered to explain the results include the type of instructional sequence implemented (interspersal or concurrent), the type of experimental design used, competing stimuli, and situational stimuli. Further research would be necessary to more conclusively support these considerations.

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